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ABSTRACT

This document provides suggestions and strategies for teachers and departmental administrators to improve retention of college students in science, engineering or technology programs. Classroom management strategies include: setting the tone in the first class, demonstrating mastery of the subject, demonstrating enthusiasm for the subject, using good classroom management, reviewing study skills, encouraging out of class study groups, assigning homework carefully, developing fair tests, monitoring student involvement during class sessions, knowing different learning styles, being aware of the barriers to learning, exhibiting professional conduct, being aware of some students' lack of support systems, encouraging high aspirations, and emphasizing the importance of mathematics. Suggestions for developing teacher-student sensitivity include studying educational psychology, encouraging all students, creating a nurturing environment, treating students respectfully, being responsive to questions, identifying students needing help early, treating men and women students alike, and being sensitive to the other demands students may have. Suggestions for instructional department management include implementing early warning identification processes, arranging for students to meet those who are working in their field, establishing good coordination between faculty and counselors, emphasizing the connection between education and employment, developing a staff-wide commitment to retention, insisting on accurate course descriptions, and calling students who are often absent. Fourteen annotated references are included. (JB)

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# BEHAVIORAL INSTRUCTIONAL & DEPARTMENTAL STRATEGIES FOR RETENTION OF COLLEGE STUDENTS IN SCIENCE, ENGINEERING OR TECHNOLOGY PROGRAMS

## How To Become An Even More Effective Teacher Or Departmental Administrator

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# BEHAVIORAL INSTRUCTIONAL & DEPARTMENTAL STRATEGIES FOR RETENTION OF COLLEGE STUDENTS IN SCIENCE, ENGINEERING OR TECHNOLOGY PROGRAMS

## How To Become An Even More Effective Teacher Or Departmental Administrator

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The present document has been enriched by ideas from more than twenty presentations by experts, participant discussions, a substantial volume of publications, and review by several colleagues, as well as the author's experience. The author takes full responsibility for any errors of omission or comission in summarizing and paraphrasing each of the ideas into items shown in the document in addition to the annotations which very briefly describe the references.

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# BEHAVIORAL INSTRUCTIONAL & DEPARTMENTAL STRATEGIES FOR RETENTION OF COLLEGE STUDENTS IN SCIENCE, ENGINEERING OR TECHNOLOGY PROGRAMS

## How To Become An Even More Effective Teacher Or Departmental Administrator

### Introduction

Faculty who teach in or administer college departments of science, engineering or technology often share similar characteristics. They tend to be among the most student-oriented campus groups exhibiting sincere concern for student success while maintaining legitimate standards. Their backgrounds often include valuable non-academic experience relevant to their disciplines and substantial formal academic credentials. Many are excellent teachers in spite of little or no formal education in pedagogy.

The strategies described below are believed to be related to reducing avoidable attrition or, put in positive terms, increasing legitimate retention and thereby enhancing the

effectiveness of the instructional enterprise. Many of these strategies have been compiled in conferences and workshops which focussed on improving retention of women and minority students in science and engineering-related programs, although it will be evident that many items apply to all students. Annotated references to related work are also provided.

The behavioral instructional and departmental strategies given here are intentionally limited to those which teaching faculty and their departments may implement and do not include institutional strategies or those which professional counseling staffs may employ.

Departmental strategies may enhance the work of the faculty in improving student retention while instructional strategies may help a good teacher become even more effective. Most faculty will find one or more ideas suggested which they may be interested in trying.

For Teaching Faculty -- Classroom Management Strategies

1) The first session with a new class is most important in that it will set an initial tone for the course. Plan it carefully and use the available class time fully. It is helpful to outline the instructional material and learning outcomes that will be included in the course, preferably along with a detailed course outline hand-out, which might include reading assignments for

each topic or session, expected dates of tests, quizzes and major examinations. You should explain how you will determine final grades, establish policy about missed tests and specify office hours that you will maintain as well as your office phone number.. You should provide a clear statement of the course goals and also explain how this course fits into the overall curriculum and how the content ultimately will be of value to the student in his/her chosen career or further formal education.

2) It is extremely important for a teacher to consistently demonstrate mastery of the subject being taught. However, when faced with a student's question that you cannot answer authoritatively, say you don't know or are not sure, but will find out and be sure to respond at the next session.

3) Along with subject mastery, you should demonstrate your enthusiasm for the subject and for the disciplinary field generally. Both enthusiasm and boredom are contagious.

4) Consider some elements of good classroom management, for example: Prepare notes, schedule time, give handouts, arrive early, use the initial minutes to cover what will be discussed and what is hoped to be achieved. Speak clearly and loudly and use selected visuals and media where appropriate.

5) If your students have not been exposed to it in an earlier course, review the elements of Design For Excellence: How To Study Smartly by Lloyd M. Cooke (1986), with your class and either provide them with this booklet (available for $1.00 from the National Action Council for Minorities in Engineering, NACME, 3 West 35th Street, New York, NY 10001; 212-279-2626) or a brief summary of it. In any event, you should be familiar with the strategies that this valuable pamphlet includes.

6) It has been demonstrated that students who regularly study and do homework together are more successful than students who always work alone. Encourage your students to form out-of-class study groups and urge them, at the very least, to exchange telephone numbers with several classmates. (See for example, Cooper, 1990, and Slavin, 1989-90).

7) Homework is a very important augmentation to most courses. Not only does it help a student to review class notes but it should reinforce what was learned in class. However, you should carefully select homework assignments which efficiently use the student's study time and avoid excessively lengthy or redundant chores. Some teachers will check that students have done each homework assignment and periodically collect them for grading or review -- the purpose of which is to motivate full participation

in the course work.

8) Tests should be carefully developed to ensure that they are fair and unambiguous. You should maintain suitable course standards but avoid overly difficult or tricky questions that only tend to demoralize students. Frequent testing is advisable for feedback so that the student knows where he/she stands. It helps your students when you grade and return tests quickly (no later than the next session) with corrections and encouraging comments wherever appropriate. In general, tests should be reviewed with the class when you return them. Difficult problems might be reviewed in more careful detail with the class to identify major barriers to problem-solving and a written solution might be distributed. You might take the time to review the pattern of student errors on a test to determine whether an item may be excessively difficult or ambiguous, or irrelevant to the topic.

9) You should monitor students interest, attention and understanding during class sessions (See Bostian, 1991). Consider taking advantage of methods of stimulating classroom activities that you may not be using. For example, incorporating the use of computers into courses when appropriate, or adding visual materials to clarify difficult concepts. Use open-ended

discussions to involve more students in classroom participation. Materials such as videotapes, compact discs, films, etc. might be available within the department, or purchased or self-made.

10) You should be aware that individuals have different strengths in learning styles and modes (See for example, Dansereau, 1987). Some learn better from visual materials than auditory stimuli, and vice versa. Some require concrete ideas and examples prior to accepting abstractions. Effective teachers will vary their methods of presentation, examples, materials, and degree of student interaction as well as try to relate the subject matter to effects on people or systems using real-life applications or analogies familiar to the students.

11) You should be aware of some of the work on the effect of cognitive style, metacognition and self-regulation on the teaching-learning process. Here are a few references which may help you to apply some of this research in your classes: Cross, 1977; Smith, 1987; Witkin, 1976; and Zimmerman, 1989.

12) You should be aware of the barriers to learning in your course which may require extra time, additional explanation, or different approaches. It is possible to get feedback from your students about what works and what doesn't work in instructional

communication and learning. Generally, be alert to ways to learn from your students and your colleagues to improve your teaching effectiveness. For example, asking students to define, discuss and explain the how and why of various concepts rather than relying on lecture as the sole method of teaching.

13) Conduct yourself as a professional and encourage colleagues and laboratory technicians to do so as well, so that the instructional staff may all be positive role models for students.

14) You should be aware that many students may not have the support systems and help that you may have had when you were a student. Students often have difficulties without reliable solutions, such as medical problems, financial problems, family friction, lack of health insurance, sibling problems, friend relationship problems, and so forth. Be prepared to offer a friendly ear and to know when to refer a student to professional counselors. Inner city students who often do not have adequate study space at home should be encouraged to use libraries, learning centers, study halls or other available college space.

15) You should encourage students to have high aspirations and goals. Urge them to participate in a curricularly-related club or other college activity. Note that social integration and

involvement in college activities tend to improve retention. (See Sheridan, et al., 1989).

16) Help students understand the importance of mathematics in the career fields of science, technology, and engineering as well as in college course work related to those fields. Encourage students studying in these fields to take more advanced math when the opportunity is available.

For Teaching Faculty -- Student-Teacher Sensitivity

17) If you have not done so, consider taking courses or studying independently in the area of educational psychology to better understand teaching-learning processes. Especially pertinent are recent findings on teaching-learning in relation to a student's culture.

18) It is critically important that a student feel comfortable and supported in the classroom. Many students do not receive encouragement at home and often it is the classroom teacher that can make the difference between a student completing the course or dropping out. Act like you believe that all students can learn, given time, effort, and your encouragement. Project a positive attitude toward all students. Some teachers will offer

extra classes before important exams.

19) You should think about and plan to create a nurturing environment in your classroom. Treat students with respect and take every opportunity to reinforce a student's self-esteem by praising student strengths and achievements. Correct student errors with positive comments and criticism demonstrating a sincere interest in the student. Show that you care. Catch a student doing something right!

20) You should understand that students are astute observers of their teachers. It will help the teaching-learning process if you like and accept your students as adults. Also, conveying warmth may be more effective than aloofness. Make an effort to remember all students names and their preferred pronunciation. Be careful to avoid calling some students by their first names and others by their last names. Consistently use one technique or the other.

21) You can demonstrate sensitivity to students feelings by being responsive to their questions and responses. In addition, you may find that the majority of the class is not learning at the rate you anticipated. Be flexible in your instructional timetable; it is better to teach 80% of the course to most of the

class than all of the material to a handful.

22) You should be prepared and alert to identify students needing help at the earliest possible time and refer them to appropriate college support services such as tutoring, counseling, health or placement offices. Some signs that a student needs help are absenteeism, declining grades, incomplete homework, and inattention in class. It is best to make a personal contact and introduction when referring a student and to follow-up to ensure that help was adequate.

23) Be fair in giving women students equal opportunities to be called on and respond as any male student, and treat their comments with equal seriousness. Sometimes males are unconsciously called on more in science, math and technology classes. (See for example, Windnall, 1988). In fields whose classes tend to be dominated by women, such as nursing, the reverse is true for males. Avoid disparaging comments or sexist humor (See Consortium for Educational Equity).

24) You should be sensitive to the demands and conflicts which students have between full-time college and full-time or heavy part-time employment, as well as family responsibilities. You might get to know your students as individuals and learn to

appreciate their problems as well as their persistence and perseverance to improve themselves.

For Instructional Department Management

Much can be done at the instructional department level to reinforce student retention and success. Some suggested strategies for effective departmental management follow.

25) Implement an early warning identification process for students with academic or other problems and follow-up procedures. Implement special tutoring for students at risk or on academic probation. Recommend guidelines for students with marginal grade point averages to carry reduced programs, without losing financial aid, or reduce outside employment working hours. Arrange for walk-in learning centers in math, science, computers and technology with paid tutors, quiet study carrels, and computer work stations. Also develop departmental seminar rooms for student study groups.

26) Arrange for students to meet selected role models who are working in their field. Recent graduates and upper class students may also serve as good role models if carefully selected. Use TV/VCR taped interviews if possible. Compile a

directory of local women and minorities in related fields from academia and industry who are available for campus programs and possibly individual mentoring. Women and minority role models should be made available to all students, not only special groups.

27) Establish close coordination between teaching faculty and counseling staff to facilitate direct and personal referrals of students and to improve understanding of curricula and careers by counselors. (See for example, Paskusz, 1985). One might invite counselors, tutors, and others to occasional department faculty meetings to develop such relationships and ensure that faculty are aware of the available support services.

28) Emphasize the connection of the curriculum to related occupations and further education. Maintain department bulletin boards with employment and continuing education information for graduates and current students. Designate one or more faculty members to actively pursue this activity and act as liaison to the college-wide placement office. Monitor the progress of graduates in both employment and further education and provide information on employers, salaries, job titles, transfer credit, further degrees, and institutions attended to current students. Also, arrange a voluntary cooperative work-study program with

local employers where positions are related to the curriculum and paid at entry levels. A display of photos and business cards of alumni can be motivational for students and faculty.

29) Develop an understanding among the departmental faculty that an effective retention process requires everyone working on it together. Develop a program to ensure accuracy and sensitivity in faculty academic advisement at registration and during the semester (See for example, Sedlacek, 1983). Make available to the faculty selected biographies or summaries thereof of minority and women scientists, engineers, inventors, architects, technicians, mathematicians and other professionals to help faculty enrich their advisement and instruction. Develop an authoritative orientation to careers in the field and include selected portions of it in several courses early in the curriculum.

30) Insist on accurate descriptions of curricular offerings and related career opportunities in promotional publications and presentations. In catalog course descriptions, add average hours per week of homework study to the listing of class hours, lab hours and credits. Offer credit by examination opportunities in as many courses as possible and develop a process to evaluate work experience to appropriately attract motivated students from

industry.

31) When a student is consistently absent have a faculty or staff member who knows the student to try to call, offer to help and encourage the student to return when possible. Institute exit interviews for all withdrawing students, but especially when women students leave the program for "traditionally female" fields or drop out all together, to determine what significant factors were related to dropping out and whether the environment was perceived to be hostile.

## Conclusion

Most instructors would agree that the teaching-learning process as practiced in higher education is far from being a perfect system and that significant improvements are achieved with considerable difficulty. Still, many instructors improve their own effectiveness by observing what produces results and intuitively adjusting their methods. Undoubtedly, many of the suggestions presented here are routinely utilized by faculty. While some items may be considered trivial, there may be others which might enhance teacher or student performance. The overall goal should be to maximize legitimate retention or, stated another way, to minimize avoidable student attrition while

maintaining suitable academic standards.

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